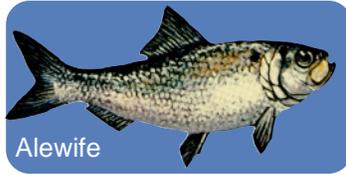




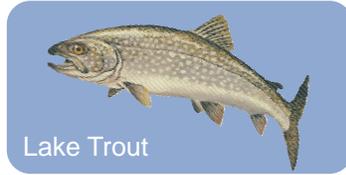
Great Lakes Fish Community Impacted by *Diporeia* Disappearance?



Walleye



Alewife



Lake Trout



Whitefish

Industry Faces Uncertain Future

Sport fishing in the Great Lakes is valued at over \$4 Billion per year, with common catches consisting of lake trout, salmon, walleye and yellow perch. With the coincident introduction of the zebra mussel and the disappearance of the important shrimp-like amphipod *Diporeia*, the Great Lakes fisheries may be disrupted.

Piscivorous fish, such as adult salmon and trout, feed mainly on prey fish such as alewife, bloater, smelt, and sculpin. These prey rely heavily on *Diporeia* for food (Figure 1). Additionally, commercial fish such as the whitefish feed mostly on *Diporeia*.

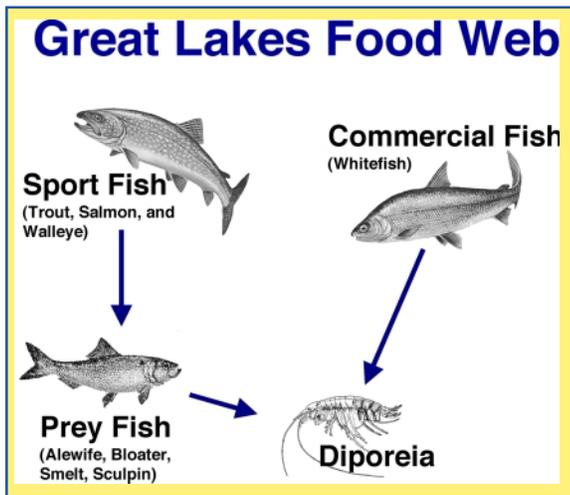


Figure 1. Foodweb role of *Diporeia*.

What is *Diporeia*?

The tiny shrimp-like organism, *Diporeia* (Figure 2) is normally the dominant benthic invertebrate in most off-shore areas of the Great Lakes. This species lives in the bottom mud and relies on settling algae from the water column as a source of food. It is believed that zebra mussels (*Dreissena*; Figure 3) are out-competing *Diporeia* for this food material. Since *Diporeia* normally make up to 70 percent of the living biomass in a given area of a healthy lake bottom, their decline in the Great Lakes may spell hard times for a variety of fish species that depend heavily on them for food.

Change in the Food Web and Potential Implications

The reduction and ultimate disappearance of *Diporeia* may change distribution patterns of some fish species or cause a shift in feeding habits.

The fishery in Lake Erie in the 1980s, before zebra mussels colonized the lake, centered on smelt, walleye, yellow perch and salmonids. Smelt were particularly abundant and supported a large commercial fishery in the central and eastern basin. The loss of the deepwater amphipod, *Diporeia*, likely accentuated the decline in the condition factor of yearling smelt and contributed to decreases in smelt stocks in 1990s.

The loss of *Diporeia* from large areas of Lake Ontario may have also disrupted the lake's food chain. Slimy sculpin and young lake trout use *Diporeia* as a key food source in Lake Ontario. In the U.S. waters of Lake Ontario, there has been a recent decline in both of these species. Estimates of abundances of slimy sculpin and lake trout showed a 95% decline between the late 1980s and 1996.

Following the zebra mussel invasion in Lake Michigan in the late 1980's, *Diporeia* densities declined dramatically. *Diporeia* disappeared from the southeastern part of the lake by 1994, and disappeared from the northern part of the lake by 2000 (Figure 4). Over the entire lake, *Diporeia* densities declined by 68% between 1994 and 2000. In southern Lake Michigan, *Diporeia* made up 25-75% of whitefish diet. Now with *Diporeia* gone, whitefish have shifted to feeding on the more abundant, but less nutritious, zebra mussel.

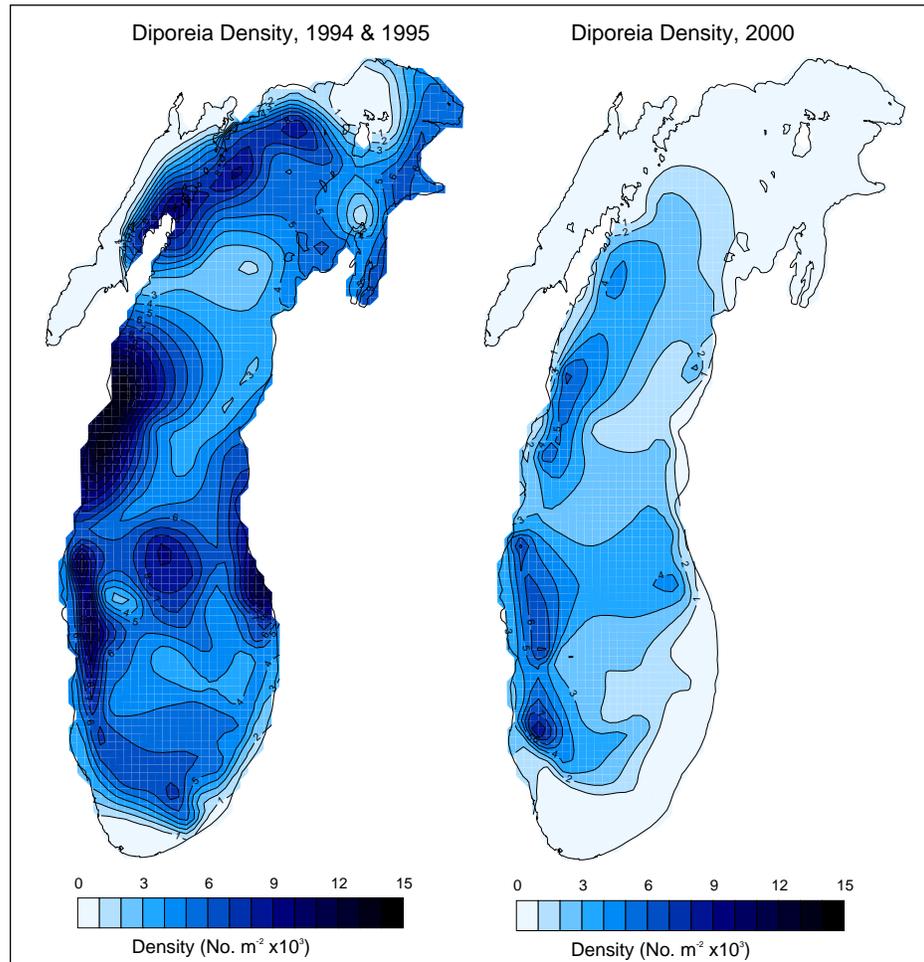


Figure 2. *Diporeia*.



Figure 3. Zebra mussel.

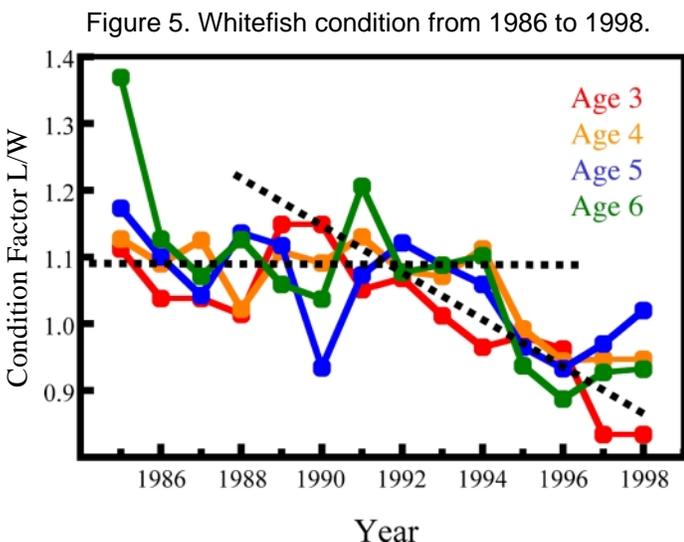
Figure 4. Densities of *Diporeia* in Lake Michigan in 1994/95 and 2000.



Declining Fish Health

After the arrival of the zebra mussel and the subsequent decline of *Diporeia* beginning in 1992, whitefish condition and weight-at-age declined. The calorie-rich *Diporeia*, which previously was a staple of the whitefish diet, was replaced with the indigestible shell material of the zebra mussel, which does not contribute to the fish’s diet energetically, but does take space in the digestive tract.

Figure 5 shows the condition of whitefish with respect to time off Grand Haven and Muskegon in the southeastern part of the lake. The Condition Factor on the y-axis denotes the fish’s health measured by a ratio of weight and length. A normal Condition Factor for whitefish in this area is approximately 1.1. The graph shows that whitefish experienced normal conditions prior to 1992 and began a significant decline in health afterwards.



What is Being Done?

Researchers at GLERL are in the process of identifying the diets of prey fish and piscivorous fish to determine the continual impact of the zebra mussel invasion, the disappearance of *Diporeia*, and subsequent food web shifts. This research is being co-funded by the Michigan Great Lakes Fishery Trust Fund. Results from these studies should enable fisheries managers to anticipate and prepare for changes in Great Lakes fish communities.

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